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# PUBLIC HEALTH REPORTS.

## UNITED STATES.

### TYPHOID FEVER AND ITS BACILLUS.—RESEARCH UPON THE ANTAGONISM BETWEEN THE COLON BACILLUS AND THE TYPHOID BACILLUS.

#### SECOND PART.

[For First Part, see PUBLIC HEALTH REPORTS No. 38, September 21, 1900.]

[By L. Rémy, D. S., M. D., chief of the bacteriological section of the State analytical laboratories, at Liège, Belgium.—Translated in the Marine-Hospital Bureau, by P. A. Surg. H. D. Geddings.—From the annals of the Pasteur Institute, November, 1900.]

The old belief in the destruction of the typhoid bacillus by the saprophytic bacteria in general and the colon bacillus in particular, dominates even at the present time the question of the pathogenesis of typhoid fever. Invoked by Gaffky to explain the ill success of his efforts to demonstrate the typhoid bacilli in the stools of typhoid patients, it was taken up later by the partisans of the Lyonnaise school, who made of it a valuable argument in favor of the colon origin of enteric fever. It was thus that Wathelet in 1894, in Malvoz's laboratory, sought in vain, at the expiration of five, ten, and fifteen days, the typhoid bacilli in tubes previously planted with three loopsful of a culture of the Eberth bacillus and one loopful of the colon bacillus. By the plate method he obtained every time a pure culture of the colon bacillus, and he concluded therefrom that the typhoid bacillus succumbed in the struggle which was established between the two microbes. The experiments of Wathelet were confirmed by Grimbert.

The results of Wathelet and Grimbert were opposed to the observations of Pottien, who proved that a recrudescence of typhoid fever was produced in 1897, among persons who made use of the water of a pump, forbidden for drinking since the prior epidemic of 1896. The Eberth bacillus, therefore, had resisted symbiosis with other bacteria. Remlinger and Schneider elsewhere found the typhoid bacillus in water during the three months which followed the subsidence of an outbreak of the disease.

In the presence of these contradictory results upon the antagonism between the typhoid and colon bacilli, depending upon whether the two organisms lived in artificially prepared mixtures, or whether they were found in conditions normal to their coexistence, new researches became necessary. They were all the more necessary, as from the experiments of Wathelet, the obliteration of the typhoid bacilli by the colon organ-

isms, was not the only interpretation which could explain the absence of typhoid colonies upon the gelatin plates. This might also legitimately be attributed to the imperfect procedures practiced by the author for isolating the typhoid organism from the mixture. It was easy for him to determine which of these two hypotheses accorded best with his results. For this it was sufficient to make control plates, and to seek for the typhoid bacillus, not after five, ten, or fifteen days of symbiosis with the colon bacillus, but at the very moment of making the mixture. We are convinced that with the aid of ordinary gelatin he would have experienced the same difficulty as in the other case. He could at the same time have replanted colonies appearing upon the plates made with the mixtures five, ten, and fifteen days after their preparation, and then he would have certainly been able to see that the typhoid bacilli survived perfectly in association with the colon bacillus.

Another reason lead us to undertake these experiments upon the antagonism between the typhoid and colon bacilli. The study of the modifications which symbiosis might bring about in these two organisms has never been made; it was interesting, therefore, to undertake the researches from this point of view, and our differential gelatin permitted us to supply this deficiency.

*Experiment 1.* We used the colon bacillus and the typhoid bacillus isolated from the stool of case No. 20. Method of procedure: In a flask of 2 liters capacity, containing 1 liter of peptonized water (Witte's peptone, 3 per cent,  $N_2CL$  10.5 per cent, and reaction exactly neutral, we planted on July 7, 5 c. c. of a twenty-four hour old bouillon culture of *B. coli communis*, and 5 c. c. of a typhoid culture of the same age. After shaking, the flask was left at room temperature, 22° to 27° C. The same process under the same conditions was repeated on a flask of peptonized water acidified by sulphuric acid after previous neutralization, to the extent of 0.5 per cent.

For the sake of clearness and conciseness we will designate by—

E. Culture in neutral peptonized water.

H. Culture in acidified peptonized water.

*B. t. s. 20.*—The typhoid bacillus from the stool of case No. 20.

*B. c. s. 20.*—The colon bacillus from the stool of case No. 20.

*Characteristics of the colon and typhoid bacilli before symbiosis.*

*B. c. s. 20.*—Gives indol, ferments lactose energetically, and is slightly motile.

*B. t. s. 20.*—Was very motile, and was agglutinated in dilution of 1-70000 by the experimental antityphoid serum.

After a variable number of days of symbiosis, we made with the mixture, by means of the differential gelatin, plates as follows:

First dilution, 1 loopful of the previously shaken mixture in 10 c. c. of distilled water;

Second dilution, 1 loopful of No. 1 in 10 c. c. of distilled water, and